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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/996,788	11/30/2001	Naokatsu Ikegami	OKI.286	4551

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EXAMINER

CHEN, KIN-CHAN

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 11/07/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/996,788	Applicant(s) IKEGAMI, NAOKATSU	
	Examiner Kin-Chan Chen	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 16-27 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 16-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114 was filed in this application after a decision by the Board of Patent Appeals and Interferences, but before the filing of a Notice of Appeal to the Court of Appeals for the Federal Circuit or the commencement of a civil action. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on October 25, 2005 has been entered.

Claim Rejections - 35 USC § 112

2. Claims 16-27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification.

In claim 16, line 5, "forming a second insulating layer on the first insulating layer and the conductive member" is new matter. Applicant does not point out where the support is in the specification.

In claim 16 (line 9) and claim 22 (line 8), "etching the second insulating layer" is new matter.

In claims 16 and 22, "essentially consists of " is new matter.

Claim Rejections - 35 USC § 112

3. Claims 16-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 22 recites the limitation "the second insulating layer " in line 8. There is insufficient antecedent basis for this limitation in the claim.

In claims 16 and 22, "essentially consists of " is vague and indefinite. It is unclear whether it "consists of " or "it "consists essentially of". For the patent examining purpose, the examiner assumes that it is "consists essentially of".

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 16-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tahara et al. (US 5,356,515; hereinafter "Tahara") in view of Yamada (US 5,827,778) and Pu et al. (US 5,843,847; hereinafter "Pu") as evidenced by Collins et al. (US 6,251,792) and Demmin (US 6,635,185).

Tahara teaches a method for manufacturing a semiconductor device having conductive path extending from an upper surface of an insulating layer of silicon dioxide on a semiconductor substrate to a conductive member embedded in the insulating layer. An etching mask may be formed on the insulating layer to define an etched hole for the conductive path. A hole may be etched in the insulating layer to the conductive member using the etching mask. A reactive gas may consist essentially of CHF_3 and CO (col. 12, lines 52-65; col. 17, lines 1-27).

The claimed invention differs from Tahara by specifying two insulating layers rather than one insulating layer in the semiconductor device. However, it is conventional to have multiple insulating layers. Yamada (see Figs 1A-1E; Figs. 2A-2B, Figs 4A-4D) is relied on to show the conventional multiple insulating layers. Because it is conventional method and because it is disclosed by Yamada, hence, it would have been obvious to one with ordinary skilled in the art to use two insulating layers such as that of Yamada.

Tahara teaches the effect of etching selectivity of CO addition to CHF_3 with various flow ratios (col. 16, lines 52-67). Tahara also shows various process conditions and states that the etching method can be performed under various conditions in addition to the conditions employed in the embodiments (col. 17, 13-30). Tahara does not disclose that a flow ratio about 15/85. In a method of silicon oxide etching, Yamada

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teaches the etchant may consist essentially of CHF_3 / CO. Yamada shows the effect of etching rate as function of flow ratio of CHF_3 / CO including a flow ratio about 15/85 (see Fig. 6). Yamada shows etching rate versus $\text{CO}/\text{CO}+\text{CHF}_3$ (therefore, with simply algebra, one can easily figure out etching rate vs. $\text{CHF}_3/\text{CO}+\text{CHF}_3$, and CHF_3/CO). As such, Fig. 6 shows that etching rate of silicon oxide drops drastically when CO increases and CHF_3 decreases accordingly, in other words, flow ratio of CHF_3 / CO is a result-effective variable. Hence, it would have been obvious to one with ordinary skill in the art to use a suitable flow ratio of CHF_3 / CO as disclosed by Yamada in order to have a desired etching rate.

Furthermore, It is well known that the etching process of using carbon-containing etchant gas produces polymeric byproducts as a passivating layer, which deposit on the sidewalls and the bottom. In a method for etching dielectric layers, Pu teaches using carbon-containing etchant gas (such as CHF_3 / CO as instantly claimed) produces polymeric products as a passivating layer which could limit the etching (col.1, lines 64- col.2, line 4). See also Tahara et al. (US 5,356,515; col. 5, lines 12-15), and Collins et al. (US 6,251,792; col. 10, lines 36-37) in the record as evidence. **Pu also teaches that thick passivating deposit layer can stop the etching process** (col. 6, lines 62- 63). Hence, it would have been obvious to one with ordinary skilled in the art to use the polymeric product generated during the etching to stop the etching in the process of modified Tahara and Yamada because Pu teaches the polymeric product generated during the etching may be used as a passivating layer which could limit the etching and

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may stop the etching and because Yamada demonstrate that the etching rate of silicon oxide drops drastically when CO increases and CHF_3 decreases accordingly.

Tahara teaches selective etching process for forming a contact hole for the conductive path. Instant claims differ from Tahara by specifying filling the hole with a conductive material for the conductive path. However, it is a conventional process step for manufacturing a semiconductor device, and Yamada teaches same (col. 1, lines 31). Hence, it would have been obvious to one with ordinary skill in the art to fill the hole formed by the etching process with a conductive material in order to complete the interconnect structure in semiconductor device fabrication.

The above cited claims differ from the combined prior art by specifying various processing parameters (such as reaction chamber pressure, 1600 W of frequency power; the flow rates of etchant, the flow ratio (of etchant). However, Tahara shows various process conditions and states that the etching method can be performed under various conditions in addition to the conditions employed in the embodiments (col. 17, 13-30). The power of the etching system and the flow rate of the etchant gas are commonly determined by routine experiment. The process of conducting routine optimizations so as to produce an expected result is obvious to one of ordinary skill in the art. Hence, a person having ordinary skill in the art would have found it obvious to modify Tahara, Yamada and Pu by performing routine experiments (different processing parameters) in order to obtain optimal result. See also Demmin (US 6,635,185; col. 7, lines 5-25) in the record as evidence. It is noted that applicant did not traverse the

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aforementioned conventionality (e.g., well-known features, obviousness), which have been stated in the office actions (April 7, 2003; July 21, 2003).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Demmin (US 6,635,185; col. 7, lines 5-25) discloses that one skilled in the art of plasma etching and cleaning may vary type of plasma etching (RIE, HDP, plasma etching..), composition, flow rate, temperature, pressure, power, time, bias, accordingly to etch a desired material satisfactorily. Collins et al. (US 6,251,792; col. 10, lines 36-37) teaches CHF_3 etchant produces polymeric products as a passivating layer.

Response to Arguments

6. Applicant's arguments filed October 25, 2005 have been fully considered but they are not persuasive.

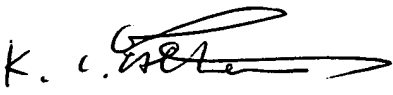
Applicant has argued that Yamada does not specifically illustrate a flow ratio of CHF_3 / CO , therefore it is not understood how Fig. 6 discloses a flow ratio of CHF_3 / CO of 15/85. It is not persuasive. As has been stated in the office action, Yamada teaches the etchant may consist essentially of CHF_3 / CO . Yamada shows the effect of etching rate as function of flow ratio of CHF_3 / CO including a flow ratio about 15/85 (see Fig. 6).

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Yamada shows etching rate versus $\text{CO}/\text{CO}+\text{CHF}_3$ (therefore, with simply algebra, one can easily figure out etching rate vs. $\text{CHF}_3/\text{CO}+\text{CHF}_3$, and CHF_3/CO). Fig. 6 clearly indicates that etching rate of silicon oxide drop drastically when CO increases and CHF_3 decreases accordingly.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kin-Chan Chen whose telephone number is (571) 272-1461. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

November 3, 2005


Kin-Chan Chen
Primary Examiner
Art Unit 1765